

Physico-Chemical Characteristics of Vadape Lake of Bhiwandi City, Dist-Thane, Maharashtra, India.

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ABSTRACT : The paper deals with physico-chemical analysis of Vadape Lake, Vadape, Bhiwandi, Dist. Thane. The investigation was carried out for the period of one year (February'15 - January'16), representing Pre-Monsoon, Monsoon and Post-Monsoon seasons. The physico-chemical parameters are very important to get precise idea about the quality of water and the results were compared with standard values. Physical and chemical parameters such as water temperature (24.5 °C to 28.125 °C), pH (7.875 to 8.138), dissolved oxygen (2.769 mg/L to 4.732 mg/L), total alkalinity (134.375 mg/L to 305.62 mg/L), total hardness (104 mg/L to 157.5 mg/L), chlorides (30.175 mg/L to 47.57 mg/L), nitrate (0.01639 mg/L to 0.03949 mg/L), and phosphate (0.004565 mg/L to 0.30775 mg/L) were investigated. The results revealed remarkable seasonal changes in the water quality and were compared with international standards laid down by WHO, CPCB, BIS and CIFE.

KEYWORDS – International standards, Physico-chemical parameters, Vadape lake.

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I. INTRODUCTION

The presence of water on earth surface is one of the main causes for existence of life. It is a basic need and most precious gift for life. Water is one of the most important and abundant compounds of the ecosystem. All living organisms on the earth need water for their survival and growth. As of now only earth is the planet having about 70% of water. But due to increased human population, industrialization, use of fertilizers in the agriculture and man-made activities, it is highly polluted with different harmful contaminants^[1]. Aquatic ecosystems are particularly vulnerable to environmental change and many are, at present, severely degraded^[2]. In recent years, increase in human population, demand for food, land conversion, and use of fertilizer have led to faster degradation of many freshwater resources^{[3][4]}. This has led to scarcity of potable water affecting the human health^[5]. Therefore, the continuous and periodical monitoring of water bodies for water quality is necessary. Pollution of water is measured by assessing the physicochemical parameters of water^[6]. The objective of the present study was to assess the ecosystem of Vadape lake by estimating the various physico-chemical parameters like water temperature (24.5 °C to 28.125 °C), pH (7.875 to 8.138), dissolved oxygen (2.769 mg/L to 4.732 mg/L), total alkalinity (134.375 mg/L to 305.62 mg/L), total hardness (104 mg/L to 157.5 mg/L), chlorides (30.175 mg/L to 47.57 mg/L), nitrate (0.01639 mg/L to 0.03949 mg/L) and phosphate (0.004565 mg/L to 0.30775 mg/L), etc.

II. MATERIALS AND METHODS

Collection of water samples

Water samples from two pre-decided sites were collected in clean polythene bottles by taking necessary precautions. The bottles were rinsed before sampling and sealed after collection and labeled in the field.

Analysis of water samples

Analysis was carried out for various water quality parameters in the field and laboratory. The surface water was collected from Vadape lake, Vadape, Bhiwandi, Dist. Thane, Maharashtra State (Figure 1 & 2) every month during early morning between 8.00 am to 10.00 am. Throughout the study period i.e., from February 2014 to January 2016. However, observations recorded during the second year of study period i.e., February 2015 to January 2016 are discussed in the present paper. Air and water temperatures were recorded on the spot. Similarly, samples for estimation of Dissolved Oxygen were fixed by adding Winkler's A and B in the BOD bottles in the field. The entire analysis was completed within 24 hrs. of collection by methods mentioned in (APHA, 2004; Trivedy & Goel, 1984) and^{[7][8][9]}. The study was divided into three marked seasons viz. Pre-Monsoon, Monsoon and Post-Monsoon.

III. METHODOLOGY

Sr. No.	Parameters	Methods
1.	Temperature	Mercury thermometer
2.	pH	Lovibond comparator and pH meter
3.	Dissolved Oxygen	Winkler's method
4.	Alkalinity	Titrimetric method (Phenolphthalein and methyl orange indicators used)
5.	Hardness	EDTA method
6.	Chloride	Argentometric method
7.	Nitrate-Nitrogen	Complexing with sulphanimide and NEDD (N-naphthyl ethylene diamine dichloride).
8.	Phosphates	Colorimetrically by using ascorbic acid

Fig. 1. Vadape lake, Bhiwandi, Dist. Thane,



Maharashtra.

Fig. 2. Satellite view of Vadape lake, Bhiwandi, Dist.



Thane, Maharashtra.

IV. RESULT AND DISCUSSION

Temperature - One of the most important physical property of an ecosystem is its temperature as it affects most of water quality parameters. The values of temperature varied from 24.5 °C to 28.125 °C, minimum value was observed in Post-Monsoon season and maximum value was observed in Pre-Monsoon season of the Vadape Lake. (Table no-1). In the present investigation, the variations in the water temperature may be due fluctuation in normal climatic condition during different seasons.

pH - According to the USEPA ^[10], accepted water quality criteria indicate a pH of less than 6.5 units may be harmful to many species of fish. According to the different standards proposed by WHO, CPCB, BIS, CIFE (listed in Table no- 1), the range of pH lies between 6.5 to 8.5. During the present investigation, the pH range between 7.875 to 8.138 units, minimum value was observed in Post-Monsoon season and maximum value was observed in Monsoon season of the Vadape Lake. (Table no-1) which would be suitable for the protection of aquatic habitats, as it is within permissible limits. The neutral and alkaline pH are shown by eutrophic and mesotrophic nature of water bodies, respectively ^[11]. Optimal pH range for sustainable aquatic life is between 6.5 to 8.2 ^[12]. Similar finding was also observed by Joshi *et al.*, 2009 ^[13], pH of the Ganga River at Haridwar was slightly alkaline. It ranged from 7.06 to 8.35.

Dissolved Oxygen - The dissolved oxygen is one of the important factors for aquatic environment and is essential for growth of fish production. WHO ^[14] has recommended 4-7mg/L of dissolved oxygen as optimum for fresh water whereas DO less than 2.5 mg/L is described to be hypoxic condition. During the present investigation the dissolved oxygen recorded was between (2.769 mg/L to 4.732 mg/L), minimum value was observed in Pre-Monsoon season and maximum value was observed in Monsoon season of the Vadape Lake. (Table no-1) in Vadape lake. Meme *et al.* 2014 ^[15] reported the range of dissolved oxygen was 6.02 to 7.01 mg/L at Oinyi River, Nigeria. Low content of dissolved oxygen assign of organic pollution, is also due to inorganic reductants like hydrogen sulphide, ammonia, nitrates, ferrous ions and other such oxidizable substances ^[16].

Alkalinity - Alkalinity in fresh water bodies results from the evolution of CO₂ during decomposition of organic matter. During the present investigation, the value of alkalinity recorded between 134.375 mg/L to 305.62 mg/L, minimum value was observed in Monsoon season and maximum value was observed in Pre-Monsoon season of the Vadape Lake. in Vadape lake. (Table no-1). The high alkalinity is a function of ions exchange, that calcium ions are replaced by sodium ions are later contributed to alkalinity^[17].

Hardness - Hardness is the measure of alkaline earth element such as calcium and magnesium in an aquatic body along with other ions such as aluminum, iron, manganese, strontium, zinc and hydrogen ions^[12]. In present study, the total hardness of Vadape lake water was found 104 mg/L to 157.5 mg/L, minimum value was observed in Monsoon season and maximum value was observed in Pre-Monsoon season of the Vadape Lake. (Table-1). On the basis of total hardness, Egemen (2011)^[18] classified water bodies into six categories; soft (hardness less than 50 CaCO₃ mg L⁻¹), moderately soft (from 50-100 CaCO₃ mg L⁻¹), slightly hard (from 100-150 CaCO₃ mg L⁻¹), moderately hard (from 150-250 CaCO₃ mg L⁻¹), hard (from 250-350 CaCO₃ mg L⁻¹) and very hard (from >350 CaCO₃ mg L⁻¹). According to those limits, Vadape lake could be classified as moderately hard.

Chloride - Chlorides are important inorganic anions which contain varying concentrations in natural waters^[19]. Chloride content in fish lakes is important to know the quality of water and sources include fertilizers from surrounding areas and animal waste^[20]. In the present investigation, chloride range from 30.175 mg/L to 47.57 mg/L. minimum value was observed in Monsoon season and maximum value was observed in Pre-Monsoon season of the Vadape Lake.

Nitrate-nitrogen - In the present investigation, nitrate content ranged between 0.016392 mg/L to 0.03949 mg/L, minimum value was observed in Monsoon season and maximum value was observed in Post-Monsoon season of the Vadape Lake. Nitrate content recorded during the study was high during post monsoon season and may be responsible for the process of eutrophication

Phosphate - Phosphate value recorded during the period of investigation was ranged between 0.004565 mg/L to 0.30775 mg/L, minimum value was observed in Monsoon season and maximum value was observed in Post-Monsoon season of the Vadape Lake. Phosphate is one of the most important nutrients and limiting factor in the maintenance of lake fertility. May be due to acidic and basic salt in water from the soap and detergents being used by local people around the lake^[21].

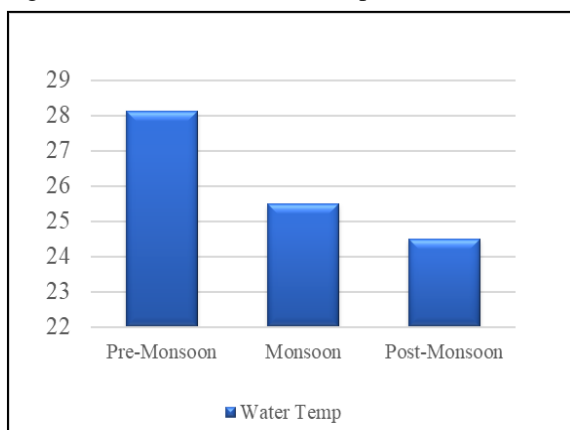
Table 1. Seasonal variation of physico-chemical parameters of Vadape lake (February 2015 to January 2016).

Sr. no.	Parameters	Pre-Monsoon	Monsoon	Post-Monsoon
1.	Temperature	28.125	25.5	24.5
2.	pH	7.9375	8.138	7.875
3.	D/O	2.769	4.372	4.706
4.	Alkalinity	305.62	134.375	228.12
5.	Hardness	157.5	104	104.74
6.	Chloride	47.57	30.175	30.353
7.	Nitrate-Nitrogen	0.016392	0.03949	0.0268
8.	Phosphate	0.087295	0.04567	0.30775

Table 2. Comparison of results with standard limits prescribed by various organizations.

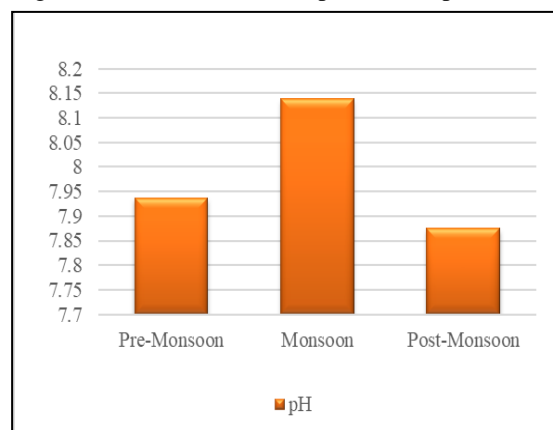
Sr. no.	Parameters	WHO	CPCB (Class-A)	BIS	CIFE	Results
1.	Temperature (°C)	NA	NA	NA	-32	24.5-28.125
2.	pH	6.5-8.5	6.5-8.5	6.5-8.5	6.5-8.5	7.875-8.138
3.	D/O (mg/L)	250	6.0	4-6	5-10	2.769-4.732
4.	Alkalinity (mg/L)	200	NA	500-200	50-300	134.375-305.62
5.	Hardness (mg/L)	100-500	NA	300	NA	104-157.5
6.	Chloride (mg/L)	250	NA	250	NA	30.175-47.57
7.	Nitrate-Nitrogen (mg/L)	20-50	20	45	0.1-4.5	0.016392-0.03949
8.	Phosphate (mg/L)	5.0	NA	NA	0.3-0.5	0.004565-0.30775

Fig. 3. Seasonal variation in Temperature ($^{\circ}\text{C}$) of



Vadape lake (February 2015 – January 2016).

Fig. 4. Seasonal variation in pH of Vadape lake



(February 2015 – January 2016).

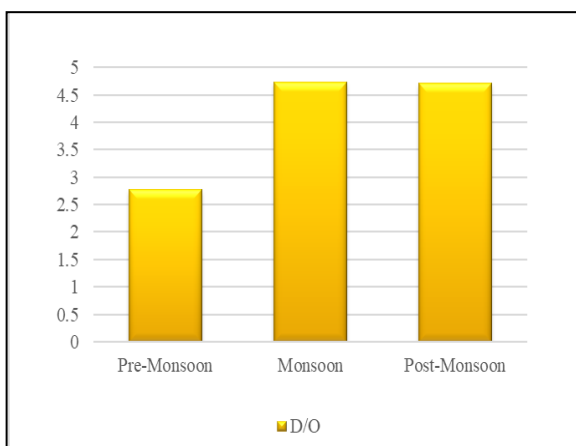


Fig. 5. Seasonal variation in Dissolved Oxygen (mg/L) of Vadape lake (February 2015 – January 2016).

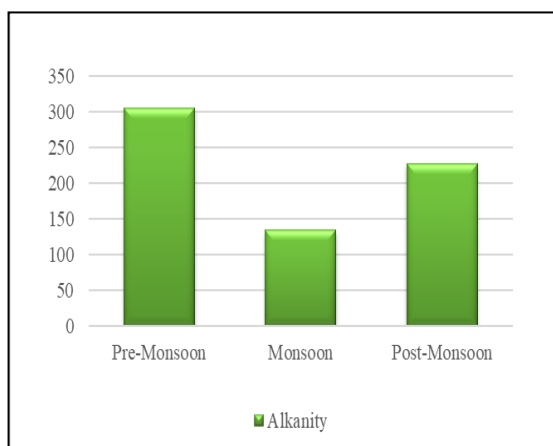


Fig. 6. Seasonal variation in Alkalinity (mg/L) of Vadape lake (February 2015 – January 2016).

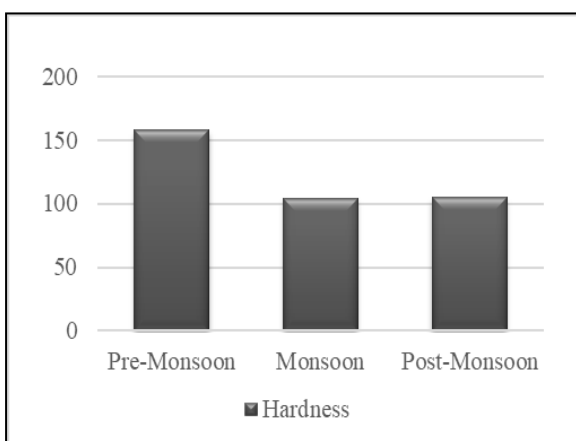


Fig. 7. Seasonal variation in Hardness (mg/L) of Vadape lake (February 2015 – January 2016).

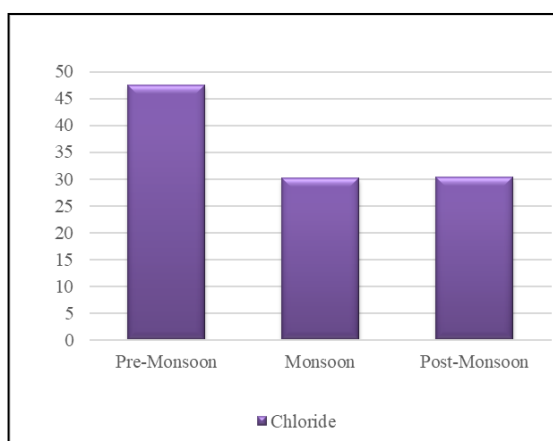
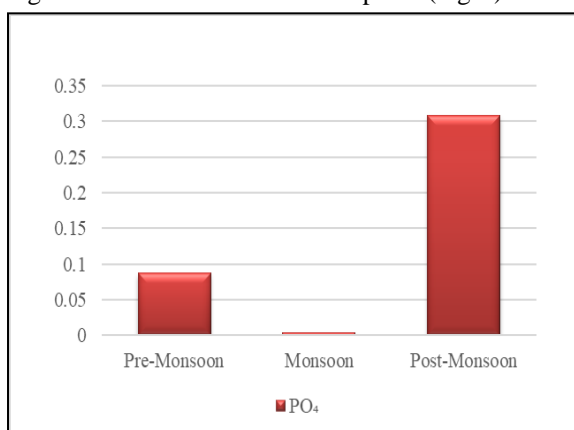


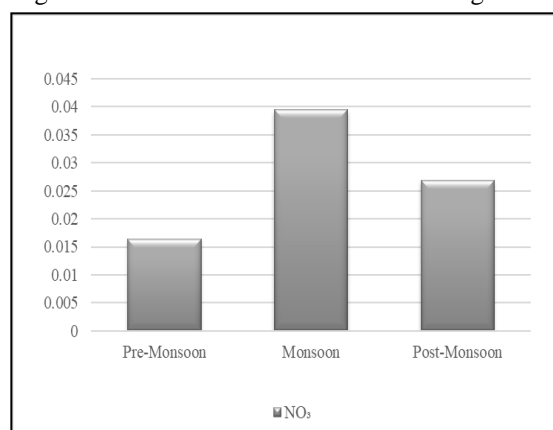
Fig. 8. Seasonal variation in Chloride (mg/L) of Vadape lake (February 2015 – January 2016).

Fig. 9. Seasonal variation in Phosphate (mg/L) of



Vadape lake (February 2015 – January 2016).

Fig. 10. Seasonal variation in Nitrate-Nitrogen



(mg/L) of Vadape lake (February 2015 – January 2016).

V. CONCLUSION

A study of Physico-chemical parameters of Vadape Lake, Vadape, Bhiwandi was carried out by taking various parameters like water temperature, pH, dissolved oxygen, total alkalinity, total hardness, chlorides, phosphate and nitrate etc. for the period of one year i.e., February 2015 to January 2016. In the present investigation some parameters were beyond the permissible limits. Hence, it is concluded that water quality is not suitable for drinking and domestic purpose.

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